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Short Communication

Studies on morphological and yield parameters of three varieties of Nigerian okra [*Abelmoschus esculentus* (L.) Moench]

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This study was carried out to assess the variation in morphological and yield parameters among three varieties (V_{35}, Jokoso and NH4e47.4) of okra [*Abelmoschus esculentus* (L.) Moench] from Nigeria. Okra seeds were collected and seedlings were raised to maturity at which stage they were examined for morphological and yield parameters. The distribution pattern in days to bud emergence and days to sexual maturity were not significantly different among the three varieties. On the other hand, the number of leaves/plant and plant height at maturity were significantly highest in V_{35}. Unlike the number of pods/plant, which was not significantly different ($P > 0.05$) among the three okra varieties, the number of seeds/pod was significantly higher in V_{35} and Jokoso than in NH4e47.4. The implications of these aspects with respect to future genetic improvement of okra are discussed.

Key words: *Abelmoschus esculentus*, morphological traits, yield traits.

INTRODUCTION

Okra [*Abelmoschus esculentus* (L.) Moench] belongs to the Malvaceae family. It is a native to tropical Africa where it serves as a staple vegetable crop (Indian Government, 2008; Kochhar, 1986; Hammon and Van Stolen, 1989). Hammon and Van Stolen (1989) also reported that there are 2,283 accessions out of which 2,029 were collected from the African continent of which 1,769 are from West Africa. The crop is therefore far more heavily represented in West Africa than in any other part of the world (Hammon and Van Stolen, 1989). It is an annual crop with a life-span ranging from 1 to 5 months depending on the species. The seeds are round, greyish and relatively large (about 1.5 to 3 mm). The importance of the crop as a vegetable lies in its wide acceptability due mainly to its flavour and viscosity which aids easy consumption of bulky and relatively hard foods like cassava pastes and pounded yam (NIHORT, 1987), in addition to being rich in vitamins A, B and C. The leaves also contain higher quantities of protein (2.7 to 3.0%) than the pods, and a significant amount of riboflavin and folic acid (Martin et al., 1979; Adelusi et al., 2006; Hegazi and Hamideldin, 2010). These popular uses of okra have fuelled an increasing demand for the crop, and a search for simple but viable ways of increasing supply of the product, independent of man-power and adequacy of farming conditions. Thus, attention has gradually shifted towards improving the genetic quality of the species through plant breeding and selection.

According to Ariyo (1992), vegetative traits of okra plants are positively correlated with yield and thus traits such as pod size must be given prime attention in the selection of okra species for breeding programmes to improve yield. In addition, the weight and number of pods/plant have been consistently identified as critical determinants of pod yield (Kault et al., 1978; Ariyo, 1989; Saifullah and Rabbani, 2009). On the other hand, Singh and Singh (1977) cited the number of pods/plant, days to flowering and plant height as being the most important parameters determining yield in okra. Akinyele and Osekita (2006) used Pearson's correlation coefficient to prove that morphological characters strongly influence

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Table 1. Mean values of morphological and yield parameters of 3 varieties of *A. esculentus* grown during the dry season in Minna.

Characters	Varieties		
	Jokoso	NH4e47.4	V_{35}
Bud emergence (days)	19.00 ± 0.82[a]	19.90 ± 0.99[a]	21.00 ± 0.00[a]
Sexual maturity (days)	32.70 ± 2.79[a]	33.10 ± 1.52[a]	34.10 ± 0.52[a]
Number of leaves/plant	9.20 ± 1.40[a]	10.80 ± 1.93[a]	12.40 ± 1.10[b]
Plant height (cm)	19.10 ± 0.99[a]	21.40 ± 1.17[a]	25.10 ± 1.10[b]
Number of pods/plant	6.50 ± 0.41[a]	5.60 ± 0.77[a]	6.10 ± 1.13[a]
Number of seeds/pod	48.70 ± 5.52[a]	54.70 ± 8.53[a]	65.30 ± 8.18[b]
Width of pod (cm)	5.08 ± 0.92[a]	5.15 ± 0.63[a]	4.95 ± 0.83[a]
Length of pod (cm)	8.43 ± 0.37[b]	5.38 ± 1.27[a]	7.96 ± 1.79[b]

*Values followed by the same letters within a row are not significantly different at $P > 0.05$ tested with DMRT.

okra yield. Variation in traits is a necessary requirement for a successful selection programme aimed at improving desirable traits. To better understand the relationship between variation in morphological and yield parameters in okra [*Abelmoschus esculentus*, L. Moench], the present study assessed such variation among three Nigerian varieties.

MATERIALS AND METHODS

Dried seeds of the three okra varieties (Jokoso, V_{35} and NH4e47.4) were obtained from the Institute of Agricultural Research, Ahmadu Bello University, Zaria, Nigeria. The viability of seeds was tested using the floatation method. They were planted in 5-L plastic buckets filled with sandy loam soil (4 seeds/bucket) at a depth of about 3 to 4 cm below the soil surface; these were later thinned to 2 seedlings/bucket, and 10 buckets/variety. Buckets were arranged in a completely randomized design (CRD). The planted seeds were watered once daily between 5.00 and 6.30 pm using bore well water from the Department of Biological Sciences, Federal University of Technology, Minna. The experiment was conducted between October and December, 2010 and the plants were monitored to avoid human and animal interference up to maturity. The morphological parameters investigated were assessed using standard procedures (Akinyele and Osekita, 2006). Specifically, bud emergence (BE), sexual maturity (SM), number of leaves/plant (NLP) were determined at maturity and plant height (PH) was determined at the flowering stage while yield was determined from the number of pods/plant (NPP), the number of seeds/pod (NSP), pod width (PW) and pod length (PL). Data were recorded regularly for 3 months using average data/plant. Data for each parameter and for each variety was pooled and used for statistical analysis. Differences between any 2 parameters were determine using a student's *t*-test and for more than 2 parameters using ANOVA.

Duncan's multiple range test (DMRT) was used to test for significant differences between means ($P < 0.05$).

RESULTS AND DISCUSSION

The days to BE among the three varieties ranged between 19.00 ± 0.82 days in Jokoso and 21.00 ± 0.00 days in V_{35} (Table 1). This indicates that the time taken for BE in V_{35} was slightly higher than in the other two varieties. The days to SM in the three varieties followed the same pattern as BE, suggesting that days to BE may not affect yield significantly in these varieties. The mean NLP was highest in V_{35} followed by NH4e47.4 and least in Jokoso (Table 1). V_{35} had consistently better vegetative growth, and may lead to increased yield performance. Mishra and Chhonkar (1979) and Nwangburuka et al. (2011) also reported considerable variation in okra vegetative and yield traits. PH was significantly higher in V_{35} than in Jokoso and NH4e47.4. According to Singh and Singh (1977) and Akinyele and Osekita (2006), days to BE and PH at maturity, among other morphological traits, are some of the most variable traits of okra that are necessary for selection programmes aimed at improving desirable traits. Since the trend of NSP for all three varieties was similar to that of other morphological parameters (Table 1), this might indicate that these factors are controlled by the same genetic variables. The highest NPP was recorded in Jokoso, the lowest PW was recorded for V_{35} in contrast to NSP and other morphological parameters that were consistently higher in V_{35} than in the other two varieties (Table 1). PL was highest in Jokoso even though this variety had consistently poor vegetative growth as measured by the other morphological parameters particularly NLP, PH and PW. Yield in okra might thus not be influenced exclusively by morphological variations. This agrees with the reports of Nwangburuka et al. (2011) but in contrast with that of Kaul et al. (1978) and Ariyo (1989) in which morphological variations (particularly NLP, PH and PW) are very important components of pod yield in okra.

The differences in yield parameters might be due to environmental influences while non-significant differences indicate that genetic components of varieties are still intact, as reported by Akinyele and Osekita (2006), Aladele (2009) and Udengwu (2009). This study indicates that vegetative productivity may not necessarily translate into yield. Therefore, any improvement programme intended for these okra varieties must target yield

parameters, especially in Jokoso, which has proven to be very productive under the prevailing environmental conditions in Minna, Nigeria. Further studies need to be carried out on these varieties in other to determine certain genetic factors that may have triggered their performance.

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